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MANAGEMENT AND PLANNING OF URBAN TREES BY MOBILE MAPPING SYSTEM

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Abstract

Countless problems that have arisen in urban woodland, because they don´t complete a planning and proper management, arise currently numerous studies to streamline the implementation of sustainable management of green areas.

Based on the sustainable management model, we create a database and use a set of Geographic Information Technology (GIT), in order to solve the current problems of urban woodland.

The area selected for this study has been the municipality of Alcorcón (Madrid), on the basis of the Plan Director of woodland road from Alcorcón, and extending it to the green zones, we introduced the "Mobile Mapping System" that is able to capture georeferenced images, and generate a cloud of points, to subsequently make a representation in three dimensions (3D) doing a geovisualization of the Park and the sustainable management of this area.

We try to provide municipalities a TIG model, in order to planning the sustainable management of its existing urban trees, avoiding potential problems by anticipating the damage that may occur in the immediate future. We will also use the TIG for the management of the new road and green areas that may be created in the future, in order to prevent anomalies, risks and incidents that are currently being.

1 Introduction

Urban woodland management is a topic of great interest for proper urban planning.

The woodland of the cities is a necessary element to create a climate of well-being for all citizens. Brings benefits to reduce pollution, regulate the temperature and humidity environment and make more pleasant cityscape in an attempt to approach to the natural environment.

The problem is that in cities that have grown very quickly, urban expansion was made without carrying out planning in the implementation of urban woodland.

We looked for tree species of shade and rapid growth, but without taking into account their dimensions and spaces for planting. We looked for very repetitive and species well adapted to the urban environment, like the Platanus (Platanus x acerifolia) and other. They were not taken into account plantation frames nor the future development of the trees. Nor was taken into account, in the aerial part, the distance to the facades, urban furnishings, to parked cars. It is also important to note that in the root zone, the safety distance to the underground facility was not raised. Criteria and recommendations based on experience for this type of interventions [1] have emerged in recent years.

Known as smart cities are characterized by using data from sensor networks. Integrate this information and then analyze it are phases necessary to make good decisions. The vegetation and other natural elements and / or artificial that are on the ground have often been the subject of study of spatial remote sensing [2] [3]. However the detection of those same elements from terrestrial mobile platforms has been

less common. In This study we present an application of Mobile Mapping System (MMS) in the management of urban trees. Gets a 3d vision of the visited area that can be complement to urban inventory of different type [4]. Geometrical data of the cloud of points that allow quick interventions on the green areas may also be removed.

1.1 Area of study

Alcorcón is one of the 179 municipalities in the province of Madrid (Spain) (Fig. 1). Its location near Madrid has been decisive in the evolution of the landscape elements. The municipality of Alcorcón has an area of 33.79 square kilometers and residents 168000. The nearly 15,000 units Alcorcon street trees are distributed in 72 different species, but its distribution is not homogeneous. There are so many units distributed in city parks.

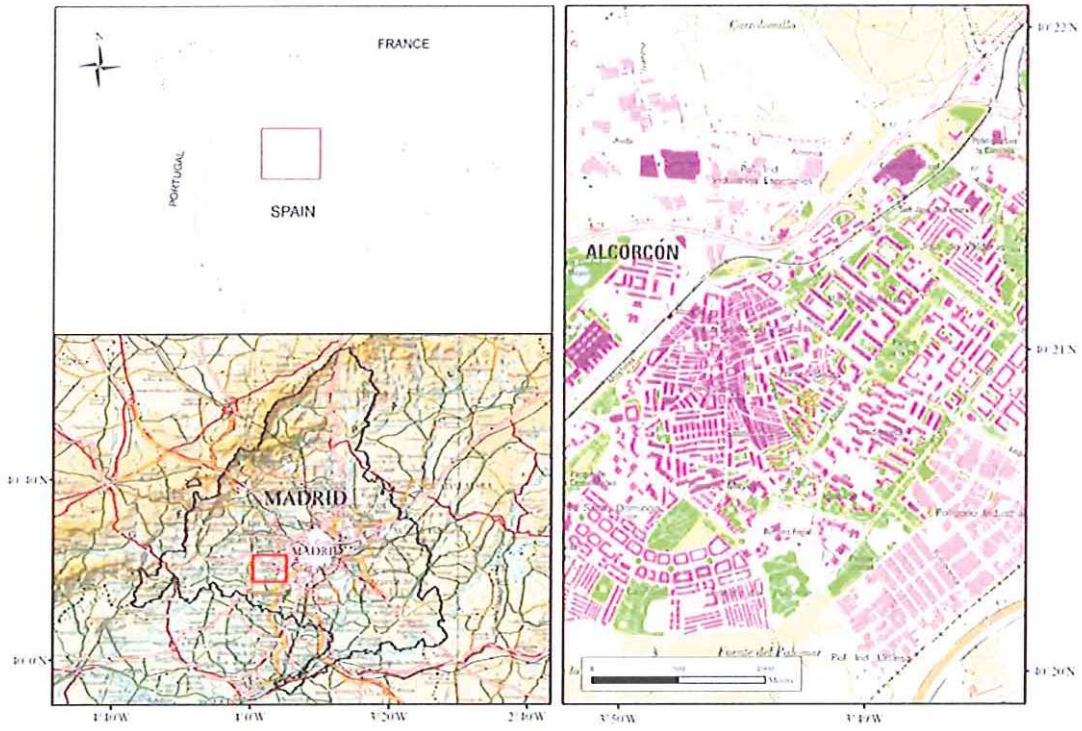

Fig. 1 Location maps of zone the experimental study (Lisboa Park-Alcorcón)

2 Method overview

Furthermore, over the last five years, some very big companies such as Google, Tele Atlas and NAVTEQ have adopted the technology on a large scale, introducing substantial fleets of mobile mapping vehicles for their imaging and mapping operations. Topcon´s IP-S2 Mobile Mapping System is a technology that is being used in studies of information systems because of its speed and accuracy in acquiring massive data [5].

The study and analysis of the historical evolution of the landscape is essential in rural and urban planning [6]. Upgrade of cartographic information has been done using data supplied by fieldwork and implemented by geographic information system Ingrid. Ingrid is the "software" that is part of all applications "Ingra" trade name under which it is distributed. You can view and edit the vector data of 2D Geo Map references on different orthophoto funds. Data for mobile laser scanning system was collected with IPS2 Topcon (Fig. 2). With the mobile mapping system in the test site was driven around twice, in clockwise and counter-clockwise

direction, at speed of about 25-35 km/h. This system can collect also image data (still cameras or video). This methodology has been used by [7] [8] [9].

Fig. 2 Map municipality of Alcorcon (INGRID System) and detail of IPS2 (Mobile Mapping System)

This work has been followed the methodology described in the scheme of the Fif. 3. The use of mobile mapping system (MMS) has been used to obtain a three-dimensional survey (3D) of the area visited. The information and data with other geodata from the current management of urban trees (Web Map Services and GIS green City-Ingrid) will give us the possibility to identify types of trees and greenery. From this inventory information and geodata will have a real and current display 2D and 3D. This current digital image, is the basis on which proposals for improving the management of urban woodland will be formulated.

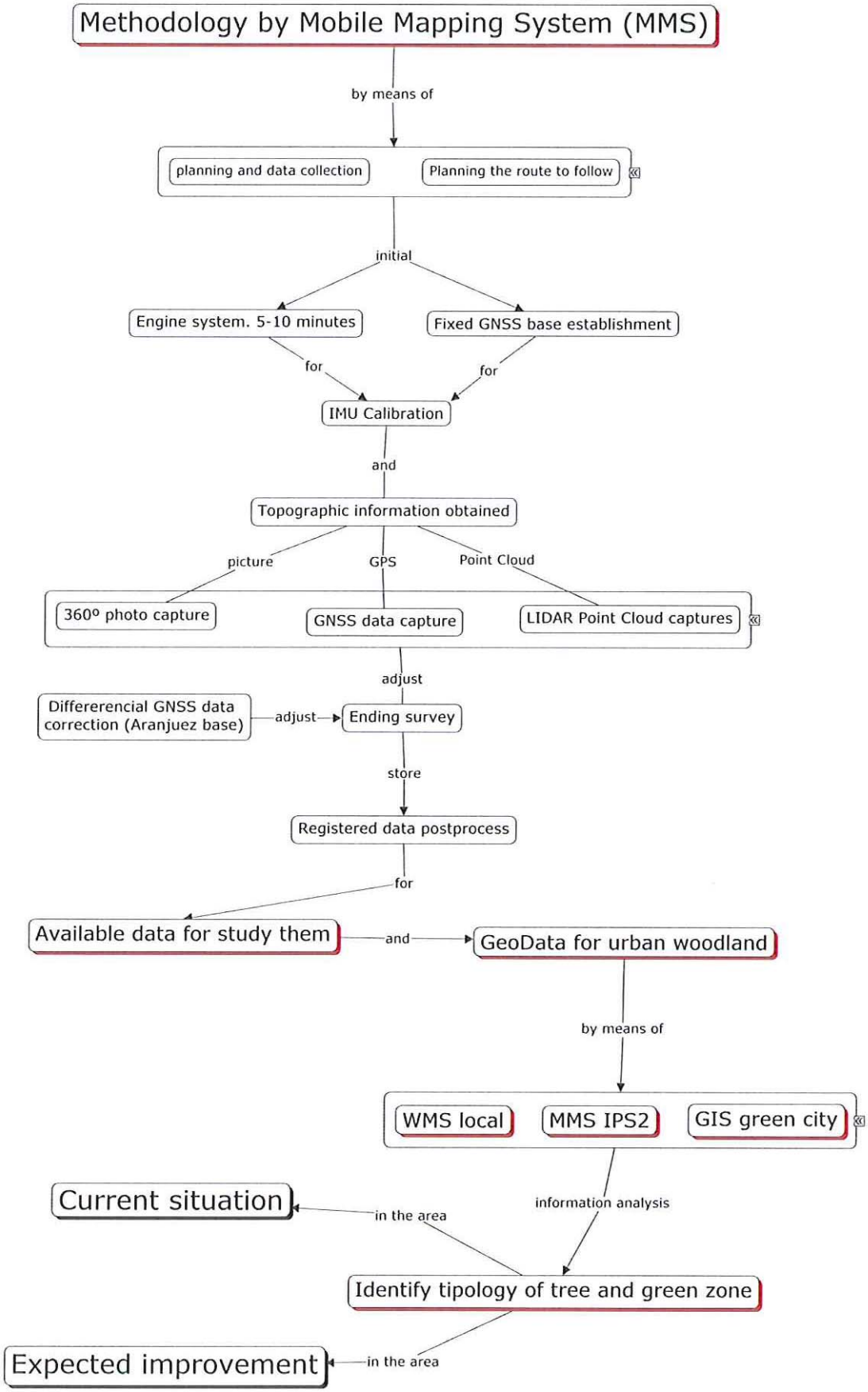

Fig. 3 Procedure for field data collection and update of the information system

The problems identified in the urban woodland are related to the environment in which they develop and perform their functions. This methodology has been taken into account the classification according to the type of damage they can cause as [10]: a) Physical type and/or mechanical problems. b) Problems related to the health of people and C) Problems that interfere with the environment in which they develop. Also other experts use these same criteria, [11].

3 Results

It has obtained a number of geodata along with graphical and cartographic information already available allow us to intervene quickly in the daily management of this type of green areas and urban trees. The ability to visualize in 3D the main elements that are part of an urban park can create valid to modify and streamline urban planning models.

The software used in data processing can be identified by the color of the point cloud high end, middle and lower model generated in the area visited. The red color corresponds to the highest part while the blue belong to the lowest.

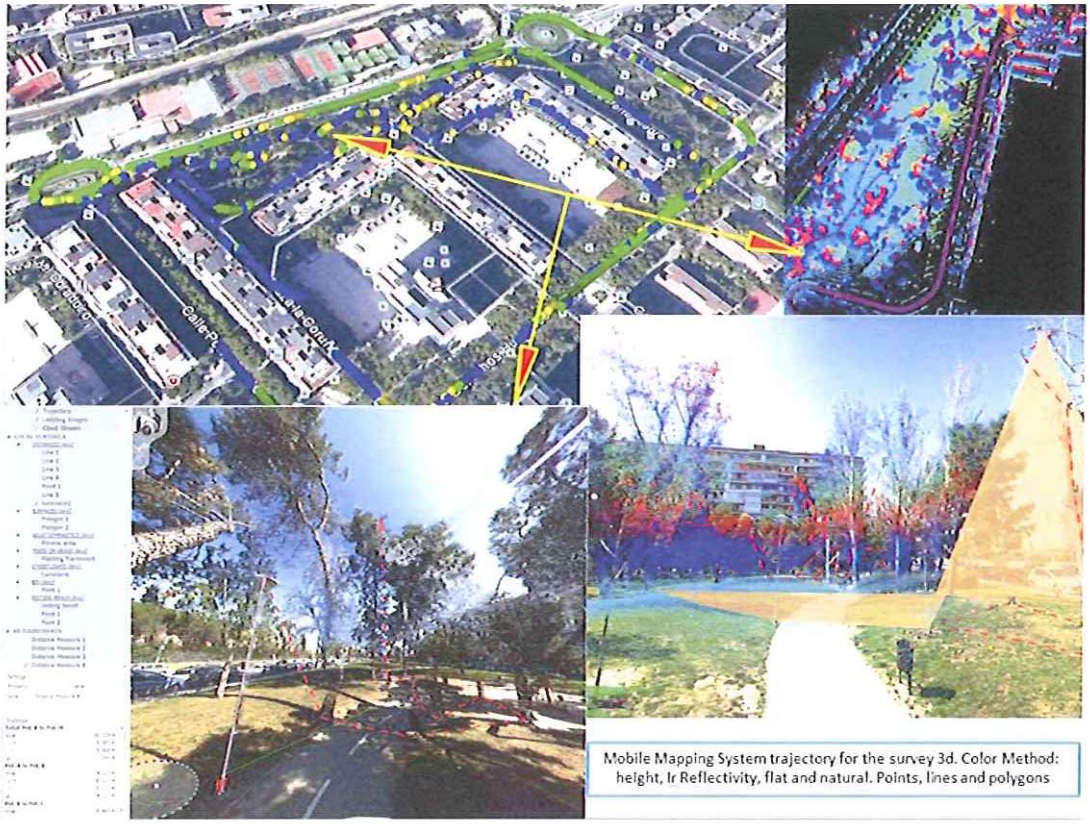

Fig. 4 Spatial Factory software: visualization of information acquired by the IPS2 system, colour of the point cloud and necessary measures

With the information obtained we can identify the species of each tree, make various measurements, such as the diameter and height of each element, minimum and maximum distances can be assessed health status and develop a comprehensive maintenance plan, Fig. 4.

From the view of the *current situation*, a new arrangement of the elements of each parterre is formulated, the closest and affected by woodland, with a new proposal to increase management efficiency. In the current situation a disorder in the distribution of urban trees is observed. For example, plantation frames inappropriate species, trees competing with each other, either in the aerial or at the radicular part, damage to the grass by trees, etc. Consequently, the *expected improvement* would be to separate one part urban trees properly ordered on the other hand, the only grass area with shrubs and flower massifs, Fig. 5.

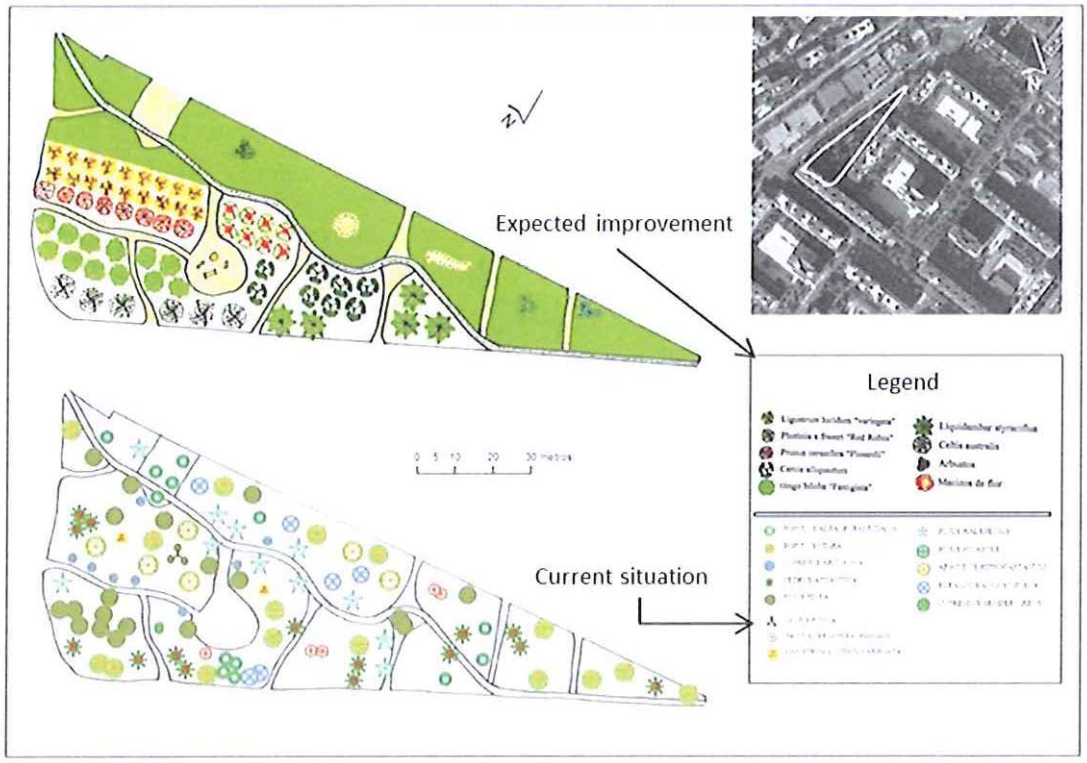

Fig. 5 Current situation and expected improvement in function of the incidences the vegetation and the urban woodland (Víctimas del Terrorismo Park)

4 Conclusion

The 3D survey of urban woodland carried out by Topcon's IP-S2 Mobile Mapping System has allowed obtaining accurate models and getting an integrated visualization of reality. Mobile Mapping System technology used successfully in urban environments, offers the possibility of different applications in green areas, from the integral study of landscape network, re-designation of areas, vegetation preservation, public forest, paved surface inspection, photo-logs, simulation, etc.

Today there is still a high demand for computer tools for the realization and management of inventories of woodland and urban green areas.

The information that is provided with this way of working can be used in different formats including devices miniaturized such as smartphones and tablets, this will lead to the optimization of management.

It's easy and fast to apply this methodology. The cost however can be high because the MMS remains an inaccessible system. However in management of large areas of medium and large cities can be very efficient.

It is a noninvasive method and as such it can be recommended for this type of operation.

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